

Diagnostic tools in Rhinology: AR, Nasal polyps and rhinosinusitis

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Accurate investigations in rhinology..?

- Problems: AR, Polyps, Rhinosinusitis
 - Impairment of Quality of life
 - Significant morbidity and even mortality
 - Serious consequences like Wegeners' granulomatosis
 - Exacerbate lower respiratory symptoms
 - May extend to involve lower respiratory tract

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Uses of investigations

- Early diagnosis
 - Correct diagnosis, Extent of disease and severity
- Management.
 - Plan: line of management, duration and followup
- Insight into
 - Pathogenesis.
 - Changes during therapy (Pharmacotherapy, immunotherapy)
 - Different forms of inflammatory and non inflammatory disease

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Diagnostic tools

- History
- Nasal examination
- Investigations: Scopy
 - Anterior rhinoscopy
 - Posterior rhinoscopy
 - Nasal endoscopy (rigid and flexible)
 - Diaphanoscopy
- Allergy tests
- Assessing sense of smell and taste
- Nasal nitric oxide
- Nasal sampling: lavages, cytology, biopsies
- Nasal patency evaluation
- Microbiology
- Blood and additional tests
- Imaging
- Future tools

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History: Recommendations

- History: Adequate time and attention
 - Complete and accurate history
 - Both rhinitis symptoms and possible co- morbidities.
 - The history should suggest further diagnostic tests
- ENT referral is needed for:
 - unilateral nasal problems
 - nasal perforations, ulceration or collapse
 - sero-sanguineous discharge
 - severe crusting within the nasal cavity
 - recurrent infection
 - periorbital cellulitis (refer urgently)
 - severe sleep problems

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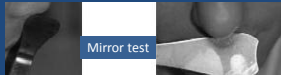
Nasal Examination

- **Inspection:**

 - Nose & face, both during inspiration & expiration
 - Major anomalies can be visualized directly
 - The shape:
 - AR: Horizontal nasal crease across the dorsum of the nose
 - Nasal polyps: widened dorsum of the nose
 - Covering skin of the nose: color changes, edema, scars
 - The surrounding structures: forehead, eyes, cheeks & upper lip
- **Palpation:**
 - Nasal obstruction

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Anterior rhinoscopy

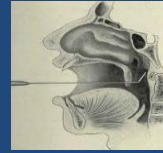


- Possible clinical findings
 - Rhinorrhoe with transparent / discoloured secretions
 - Asymmetries (nasal septum)
 - Mucosal aberrations or edema
 - Nasal polyps
 - Neoplasms, corpora aliena, etc.
 - One can assess the accessibility of the nose and the shape of the conchae.

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Posterior Rhinoscopy



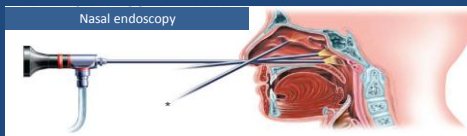
- Possible conditions
 - Congenital choanal atresia,
 - Acute adenoiditis
 - Irritation of the rhinopharynx,
 - Postnasal discharge
 - Antro-choanal polyps and
 - Thornwald cysts.

- Often replaced by nasal endoscopy

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Nasal endoscopy

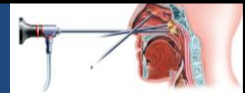


- Advantage of global evaluation of endonasal cavity
- Good evaluation of the septum, the whole nasal cavity & the nasopharynx .
- Area of the middle meatus: clinical importance in rhinosinusitis.

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Nasal endoscopy



- Technique:
 - Flexible or rigid scope attached to a strong light source by glass fibre.
 - Diagnostic examination: Scope with optic angle 25-30°, calibre 2.5-4 mm
 - Other optics: mostly used in surgery
 - Preceded by local anaesthetic preferably in combination with decongestivum
- Moderately sensitive and highly specific in predicting CT scan results.
- Nasal polyps: presence and severity can be scored by validated systems with a good reproducibility.
- Correlation between size of polyps and the subjective symptom ...!



Allergic and inflamed mucosa, secretions or swelling in the middle meatus, and possible presence of nasal polyps are evaluated

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Diaphanoscopy



- Transillumination of human tissue or a cavity with a light source to evaluate the opacity of the hollow sinus.
- Maxillary sinus:
 - Light source in the mouth of the patient, watched in a darkened room.
 - Sinus is accessible (vacant): light shines through sinus and pupil.
- The frontal sinus:
 - light source is placed at the bottom of the frontal sinus.
- Useful only in case of a unilateral acute maxillary or frontal sinusitis of an adult patient, who did not yet undergo sinus surgery

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- Inspection, palpation and anterior rhinoscopy
 - easy and rapid ways
 - corner stone of every physical examination.
- Persistent nasal symptom: complete and thorough examination using nasal endoscopy.
- Rigid endoscopy : more patient friendly and better image

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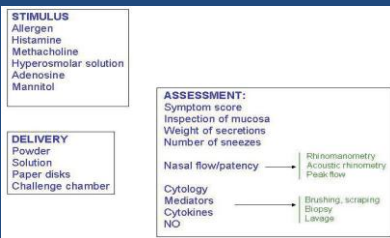
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Allergy tests

- Presence of specific IgE
 - in vivo (skin tests, SPT)
 - In vitro (RAST, CAP-RAST & equivalent assays)
- SPT:
 - Unanimously considered the gold standard
 - First-line approach for allergic sensitization
 - efficiency, safety and relatively low costs.

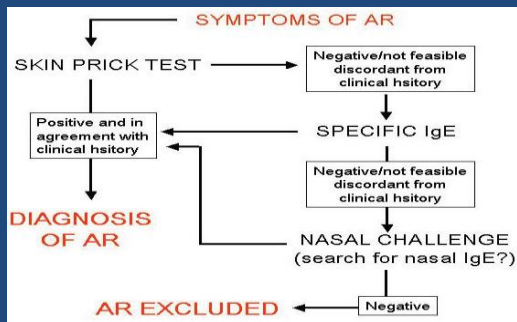


Nasal provocation tests



- **Non-specific nasal challenges:**
 - Stimuli may directly act on a single receptor
 - histamine, adenosine monophosphate, and methacholine,
 - Activate complex mechanism
 - Mannitol, capsaicin, hyperosmolar solutions and cold air.

AR: Diagnosis



Assessing sense of smell

- Rhinitis and/or rhinosinusitis:
- Complain of smell and taste dysfunction
 - Smell tests
 - University of Pennsylvania Smell Identification Test (UPSIT)
 - Connecticut Chemosensory Clinical Research Center Test (CCCRC)
 - Smell diskettes test
 - Odourant confusion matrix
 - Alcohol sniff test
 - Random test etc..

Assessing sense of taste

- Five basic taste sensations: salt, bitter, sour, umami & sweet
 - Sour taste: Citric acid or hydrochloric acid
 - Bitter taste: caffeine or quinine hydrochloride
 - Salty taste: sodium chloride
 - Sweet taste: saccharose
 - Umami taste: monosodium glutamate
- Electrogustometry: widely used to examine sensitivity

Nasal NO

- Role of NO:
 - Complex: possibly include antibacterial effects, pro-inflammatory effects, & regulation of blood flow & ciliary beat frequency.
 - Exhaled NO levels: Raised in eosinophilic asthma
- Provide a rapid, low cost, objective measure inflammation.
- greater levels of NO are produced in the upper than in the lower respiratory tract
- Measurement: Chemilluminescence- non-invasive techniques

Nasal Sampling: lavages, cytology, biopsies

- Nasal blow secretions
- Nasal lavage
- Sinus packs / filter paper
- Endoscopy guided swab
- Microsuction technique
- Nasal brush
- Nasal scraping
- Nasal biopsy: Polyps, Papilloma

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Comparison of different techniques

Method	Advantage	Disadvantage
Nasal blown secretions	- easy to perform	- subject must be able to blow nose - no information about mucosa
Nasal lavage	- easy to perform - luminal proteins, cells, mediators and cytokines	- reliability depends ability of subject to close nasopharynx - dilution of mediators and cytokines - variable recovery of fluid - no information about mucosa
Sinus packs or filter paper	- no/limited dilution of mediators	- may irritate the nose - cannot collect cells - no information about mucosa - more difficult than lavage
Microsuction technique	- no dilution of mediators	- representative sample? - technically difficult - cannot collect cells - no information about mucosa
Nasal brush	- sample of epithelium	- no sample of deeper layers - no information about nasal lumen - technically more difficult
Nasal scraping	- sample of epithelium	- no sample of deeper layers - no information about nasal lumen - technically more difficult
Nasal NO	- non-invasive	- measure of inflammation and blockage
Nasal biopsy	- sample of total nasal mucosa	- no information about nasal lumen - technically difficult

Evaluation of Nasal Patency

- Peak nasal inspiratory flow
- Rhinomanometry
- Acoustic rhinometry



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Microbiology

- Colonization versus infection
- Culture sensitivity:
 - Swab from Nose or Sinus...?
 - poor correlation: Misinterpretation of the results.

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Evaluation of Mucociliary Clearance

- Mucociliary clearance time
- Nasal NO (very low) in contrast to CRS, NP and other nasal inflammatory conditions.
- Electron microscopy evaluation of the epithelial cilia
- Ciliary beat frequency measurement
- The definite proof epithelial cell cultures & Ciliogenesis in vitro

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Blood and Additional Tests

- **Allergic Rhinitis:**
 - Allergen-specific IgE.
- **Severe non-infectious, non-allergic rhinitis:**
 - Full blood count (AEC),
 - thyroid function, thyroid auto- antibodies
 - Anti- nuclear antibodies, extractable nuclear antibodies (anti-Ro & anti La: Sjogren's syndrome- QLIPS)
 - pregnancy test or tests for drugs of addiction on urine.
 - Beta-2 transferrin, Glucostix test strips

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Blood and Additional Tests

- **Rhino Sinusitis without polyyps**
 - Full blood count: TC, DC, ESR and/or C Reactive Protein
 - Renal, liver and thyroid function
 - Humoral immunity markers: IgG subclasses, specific antibody levels (tetanus, haemophilus, pneumococcus) and response to immunization if low
 - cellular immunity markers: T and B cell numbers and ratios
 - HIV status.
 - Serum ACE level
 - c-ANCA

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Blood and Additional Tests

- **Rhino Sinusitis with polyyps**
 - Churg Strauss syndrome(CSS):
 - ANCA's (pANCA pattern with specificity for MPO)
 - Aspirin sensitivity:
 - Aspirin provocation test
 - Cellular antigen stimulation test (CAST)
 - Fungal sinusitis:
 - Deficits in the innate and acquired immunity
 - Primary ciliary dyskinesia:
 - Mucociliary clearance time, Nasal NO, Electron microscopic evaluation, ciliogenesis in vitro
 - Cystic fibrosis:
 - Blood analysis for CFTR gene mutations (homozygote & heterozygote gene mutations)

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Imaging in Rhinology

- X-ray
- USG
- CT: MDCT, MSCT
 - Caution in Children..!
 - Timing..
- MRI
- CT + MRI:
 - Complimentary..!



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Radiological Evaluation

- A CT scan
 - mandatory before sinus surgery
 - during surgery
- MRI
 - helpful for the diagnosis of fungal disease and tumor or if intracranial extension of disease is suspected.



Summary

AIMS	METHODS INSTRUMENTS	RECOMMENDATIONS
HISTORY	<ul style="list-style-type: none"> * Personal communication * Questionnaires 	Essential part of diagnostic process in all patients with nasal problems... and in those with lower respiratory tract disease!
QOL TOOLS	<ul style="list-style-type: none"> * Generic * Disease-specific 	Helpful in clinical practice and clinical trials
NASAL EXAMINATION	<ul style="list-style-type: none"> * Inspection rhinoscopy * Ant. and post. rhinoscopy * Nasal endoscopy 	<ul style="list-style-type: none"> * Non-ENT doctors should examine the nose including ant. rhinoscopy * A nasal endoscopy is recommended in chronic rhinologic disease
ALLERGY TEST	<ul style="list-style-type: none"> * Skin prick test * Blood analysis with allergen-specific IgE 	Recommended in all patients with clinical suspicion of allergic All disease
NASAL PROVOCATION TEST	<ul style="list-style-type: none"> Provocation by inhalation, spray, nasal drop or discette 	Recommended in case of doubt about sensitization

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AIMS	METHODS INSTRUMENTS	RECOMMENDATIONS	
SMELL TEST	Evaluation of the smell capacity	<ul style="list-style-type: none"> Different tests are currently available 	Recommended in case of severe hyposmia or anosmia
TASTE TEST	Evaluation of taste capacity	Electrogustometry	Recommended in patients with taste dysfunction
NASAL PATENCY MEASUREMENTS	Evaluation of a patients' capacity to breathe through the nose	<ul style="list-style-type: none"> * PNF * Anterior rhinomanometry * Acoustic rhinometry 	<ul style="list-style-type: none"> Recommended parameter in clinical trials Helpful in clinical practise to evaluate the evolution of nasal patency
NO measurement	Evaluation of NO levels in nasal cavity	Chemiluminescence reaction of expired air	Helpful as screening tool in PCO
NASAL SAMPLING	Collection of nasal mucosa/cells/ secretions for analysis	<ul style="list-style-type: none"> * Nasal secretions * Nasal scraping * Nasal biopsy 	<ul style="list-style-type: none"> Recommendations: * nasal sampling in experimental/clinical studies * nasal secretions for B2 transferin analysis in suspicion of CSF leak * biopsy in case of unilateral/malignant disease
BLOOD AND ADDITIONAL TESTS	<ul style="list-style-type: none"> Evaluation of the sensitization state, immune system, endocrine system Evaluation of mucociliary function Evaluation of chloride content in sweat 	<ul style="list-style-type: none"> * Blood test * MCT, nasal NO, EM, ciliogenesis in vitro * Sweat test 	Recommended as diagnostic tool in severe rhinitis, rhinosinusitis and nasal polyyp disease with suspicion of underlying auto-immune, immunologic or ciliary disease

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References

- Scadding et al. Diagnostic tools in Rhinology EAACI position paper. Clinical and Translational Allergy 2011, 1:2.
- Google images for Pictures